



**Speech, language and swallowing impairments in functional neurological disorder: A scoping review.**

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Speech, language and swallowing impairments in FND

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**Running head:** Speech, language and swallowing impairments in FND

**Key words:** functional neurological disorder, psychogenic, speech, dysarthria, dysphasia, dysphagia

For Peer Review Only

1 Speech, language and swallowing impairments in FND  
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4 **Declaration of Interest**  
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6  
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Speech, language and swallowing impairments in FND

**Structured Abstract:**

*Background:* Functional neurological disorder (FND) is common across healthcare settings.

The Diagnostic and Statistical Manual of Mental Disorders states that speech and swallowing symptoms can be present in FND. Despite this, there is a dearth of guidelines for speech and language therapists (SLTs) for this client group.

*Aim:* To address the following question in order to identify gaps for further research: What is known about speech, language and swallowing symptoms in patients with FND?

*Methods:* A scoping review was conducted. Six healthcare databases were searched for relevant literature: CINAHL PLUS, MEDLINE, ProQuest Nursing and Allied Health Professionals, Science Citation Index, Scopus and PsychINFO.

*Main Contribution:* 63 papers were included in the final review which ranged from 1953 to 2018. Case studies were the most frequent research method (n=23, 37%). “Psychogenic” was the term used most frequently (n=24, 38%) followed by “functional” (n=21, 33%). Speech symptoms were reported most frequently (n=41, 65%), followed by language impairments (n=35, 56%) and then dysphagia (n=13, 21%). Only 11 publications comment on the involvement of SLTs. Eight papers report direct speech and language therapy input however none studied the effectiveness of speech and language therapy.

*Conclusion:* Speech, language and swallowing symptoms do occur in patients with FND yet is a highly under-researched area. Further research is required to create a set of positive diagnostic criteria, gather accurate data on numbers of patients with FND and speech, language or swallowing symptoms and to evaluate the effectiveness of direct speech and language therapy involvement.

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4 **What this paper adds:**  
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6 *What is already known on the subject*  
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9 Functional neurological disorders (FND) are not included in the Royal College of Speech and  
10 Language Therapist's *Clinical Guidelines* (2005). Therefore a scoping review was conducted  
11 in order to discover what literature currently exists on the topic of FND and speech and  
12 language therapy.  
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21 *What this paper adds to existing knowledge*  
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23 This scoping review highlights that functional speech, language and swallowing symptoms  
24 do exist in patients with FND, with dysarthria listed as the second most common symptom  
25 observed in patients with functional stroke mimics. This area is, however, largely under-  
26 researched and this paper highlights multiple avenues for further research.  
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35 *What are the potential or actual clinical implications of this work?*  
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37 Further research and consensus guidelines are required in order to agree on terminology to be  
38 used consistently within clinical practice and to develop a set of positive diagnostic criteria.  
39 Focussed descriptive research is required in order to accurately report on numbers of patients  
40 with FND with speech, language or swallowing symptoms. Empirical research is also needed  
41 in order to assess the effectiveness of direct speech and language therapy involvement in  
42 order to improve outcomes for patients with FND in the future.  
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Speech, language and swallowing impairments in FND

## Introduction

Functional neurological disorder (FND) is common across healthcare settings. It has been shown to be the second most common diagnosis in neurology clinics (Stone *et al.* 2010a) and exist in 7% of patients on a neurology ward (Parry *et al.* 2006). Functional stroke mimics also comprise up to 2% of stroke admissions (Vroomen *et al.* 2008) and represent 7.4% of stroke mimics (Gibson & Whiteley 2013). FND includes a wide variety of motor or sensory symptoms which would usually be under a person's voluntary control, such as walking, talking or swallowing. In FND these symptoms occur in a way which is incompatible with known neurological conditions and which have a clinically significant impact on a person's functioning (American Psychiatric Association 2013). Historically, a psychological stressor was required to make a diagnosis of FND. This requirement was reclassified as optional, however, for the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association 2013). This reflects a shift in nomenclature from terms such as "hysteria" and "psychogenic" which assume a psychological aetiology, to terms such as "functional" which are broader and fit with a biopsychosocial model of aetiology (Ganos *et al.* 2014a; Demartini *et al.* 2016).

Diagnosis of FND should be made by a neurologist following detailed assessment from an interdisciplinary team. It should not be a diagnosis simply of exclusion (Edwards & Bhatia 2012). Neurologists are encouraged to approach history taking in a structured format, to give the patients a diagnostic label and to show patients their physical signs (Carson *et al.* 2012). Management of FND begins with the explanation of the disorder itself (Stone *et al.* 2016a). Other possible treatment options include: pharmacotherapy, physical therapy, cognitive behavioural therapy and hypnosis. An interdisciplinary approach is often recommended,

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4 although more robust research is required to assess the effectiveness of treatments for FND  
5  
6 (Stone *et al.* 2005; Edwards & Bhatia 2012).  
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9  
10 Speech and language therapists (SLTs) have a role in contributing to the assessment and  
11  
12 diagnosis of neurological conditions through the specialist assessment of motor speech  
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14 disorders, language impairments, swallowing disorders, voice difficulties and cognitive  
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16 communication disorders. The DSM-5 states that both speech and swallowing symptoms can  
17  
18 be present in FND. SLTs, therefore, have the specialist skills to identify when speech,  
19  
20 language, swallowing, voice or cognitive communication symptoms occur in a way  
21  
22 incompatible with known neurological conditions and thus contribute to the diagnosis of  
23  
24 FND. Despite this, there is no mention of FND in the Royal College of Speech and  
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26 Language Therapists' (RCSLT) *Clinical Guidelines* (2005). Although “psychogenic” is  
27  
28 listed as a possible aetiology of dysphagia, no detailed guidelines currently exist on the  
29  
30 management of this client group (RCSLT 2018).  
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36 Despite there being a lack of guidelines specific to FND, SLTs are currently involved in the  
37  
38 management of some functional conditions. For example, functional dysphonia and globus  
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40 pharyngeus are diagnoses which are embedded into routine clinical practice (RCSLT 2005;  
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42 Baker 2016; Baumann and Katz 2016). Awareness of functional speech conditions, such as  
43  
44 stuttering or foreign accent syndrome, are also increasing in recent years; however these are  
45  
46 “frequently ignored and often not emphasized” (Duffy 2016: 380). Anecdotally, however,  
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48 SLTs encounter functional symptoms other than those listed above, such as aphasia,  
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50 dysgraphia or oropharyngeal dysphagia. The purpose of this review, therefore, was to  
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52 address the question: What is known about speech, language and swallowing symptoms in  
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54 patients with FND? A scoping review was conducted with the aim of identifying gaps for  
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56 further research.  
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Speech, language and swallowing impairments in FND

## Method

This scoping review was based on the methodological framework proposed by Arksey and O'Malley (2005) and further developed by Levac *et al.* (2010) and Peters *et al.* (2015). The purpose of a scoping review is to “examine the extent, range and nature of research activity” (Arksey & O'Malley 2005:21). It aims to cover breadth of knowledge on a complex topic as opposed to depth of knowledge in a specific area. For this reason, assessment of quality of included studies is not a standard component in scoping reviews. They are useful for topics with emerging evidence in order to map what is currently known on a topic as they allow the inclusion of all types of published work. Scoping reviews are adept at identifying gaps for further research and as such are increasingly being used in health research (Pham *et al.* 2014).

An initial Internet search of our topic highlighted a dearth of research. We therefore selected the scoping review method as it allowed the inclusion of a wide range of study designs in order to address our broad research question. A five stage methodological framework was used: 1) identifying the research question, 2) identifying relevant studies, 3) study selection, 4) charting the data and 5) collating, summarising and reporting the results (Arksey & O'Malley 2005).

### *Identifying the research question*

Our initial research question included the parameter of inpatient settings only. This yielded minimal results, however, and was not effective in providing a wide coverage of the topic area. Therefore, the research question was revised to include all settings and to be intentionally broad in order to generate an expansive coverage of potential studies (Levac *et al.* 2010). We focussed on the question: What is known about speech, language and swallowing symptoms in FND? A broad spectrum of symptoms was included in the original



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4 search terms (please see Appendix I). In line with the scoping review methodology, the  
5  
6 parameters of what symptoms to include and definition of FND were later refined following  
7  
8 familiarity with the literature and are outlined below.  
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### 10 11 12 *Identifying relevant studies* 13

14 An initial Internet search and hand searching of journals was completed in order to identify  
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16 key terms for our question. The advice of a health sciences librarian was sought in order to  
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18 identify further key search terms and also relevant databases to search. 12 different search  
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20 terms for FND were used to search the databases (see Appendix I).  
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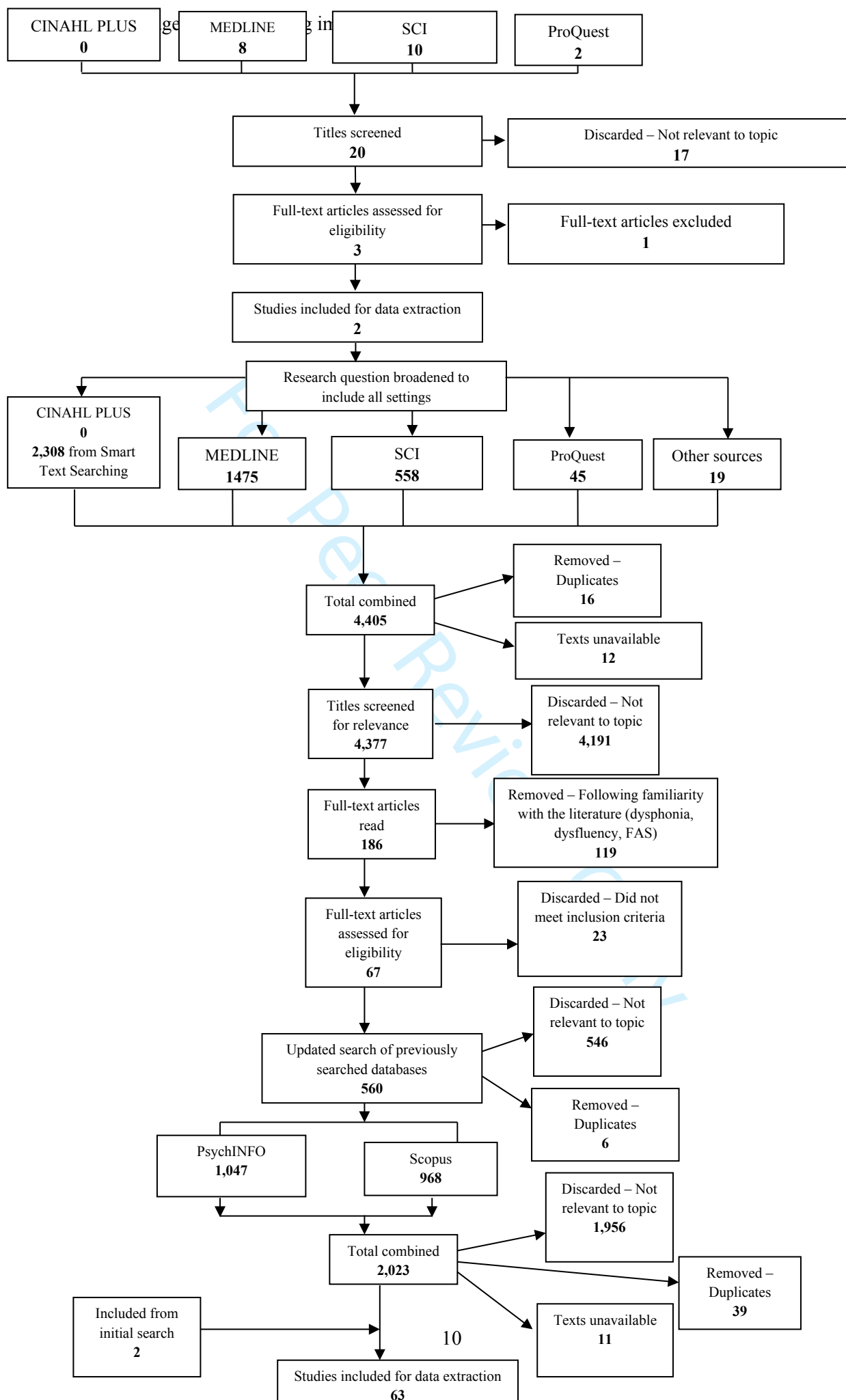
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24 The original search was conducted in January 2017 and the following electronic databases  
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26 were searched using Boolean terms: Cumulative Index to Nursing and Allied Health  
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28 Literature (CINAHL PLUS), MEDLINE, ProQuest Nursing and Allied Health Professionals  
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30 and Science Citation Index. The Boolean/Phrase search for CINAHL PLUS database  
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32 returned no results however 2,308 results were returned using their Smart Text Searching and  
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34 these were screened for relevance. Reference lists were searched for further potential studies  
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36 as well as professional networks and Google Scholar. In order to capture recently published  
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38 research, the search on the above databases was re-run in September 2018. Two further  
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40 databases, Scopus and PsychINFO, were also searched in order to gather further studies to  
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42 answer our question (see Figure 1).  
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48 Only studies in English language and focussing on adults were included. No date limits were  
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50 set as it was anticipated there would be limited research on the topic and our aim was to be as  
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52 broad as possible. Our scoping review included quantitative and qualitative studies as well as  
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54 grey literature.  
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4 *Study selection*  
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7 Criteria for study selection were iteratively revised throughout our process, in line with the  
8  
9 scoping review method and are outlined below (Levac *et al.* 2010). As stated, our initial  
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11 search included inpatient settings only so a further search to include all settings was  
12  
13 completed (see Figure 1). In January 2017 the lead reviewer initially screened 4,405 search  
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15 results and removed irrelevant articles. The Smart Text Search results from CINAHL PLUS  
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17 were screened until a point of saturation and irrelevance was reached (466 articles). Two  
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19 reviewers then screened 186 titles and abstracts for further review and 67 full texts were read  
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21 and considered for inclusion by both reviewers.  
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Figure 1: Flow chart of searching strategy. SCI=Science Citation Index; FAS=foreign accent syndrome

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4 Following familiarity with the literature, the following symptoms were excluded from our  
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6 search: dysphonia, globus pharyngeus and dysfluency. This is because these symptoms in  
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8 relation to psychogenicity are well established among SLTs. Foreign accent syndrome was  
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10 also excluded from this review. This is because foreign accent syndrome has an emerging  
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12 literature with regards to both organic and functional origins. It is a diagnostic label which  
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14 many will recognise as a term, even if not fully understood. The aim of this review was to  
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16 focus on symptoms which are not as universally recognised with regards to FND.  
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20 Oesophageal dysphagia was also excluded. Although SLTs can, and often are, involved in  
21  
22 the assessment of patients with oesophageal dysphagia, it was not the focus of this review.  
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24 Limits were set in order to refine the question into a manageable piece of work.  
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28 We only included studies which adhered to the DSM-5 criteria of FND (American  
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30 Psychiatric Association 2013). This means that a psychological stressor was not necessary  
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32 for diagnosis of FND, as was suggested in previous versions of the DSM. The DSM-5 also  
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34 specifies factitious disorder and malingering as differential diagnoses to FND. Our initial  
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36 database search included terms such as “Munchausen” and “malingering”. Due to the fact  
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38 that terminology and diagnostic criteria have evolved over time we used broad search terms  
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40 initially in order to capture all possible articles for inclusion. If, when reading the full text, a  
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42 definitive statement of conscious intent to feign symptoms was given then articles were  
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44 excluded. Studies involving litigation were excluded due to the high possibility of  
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46 malingering.  
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51 When the search was re-run in September 2018 on the four databases, a further 560 papers  
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53 were found. Eight of these met the above inclusion criteria, as agreed by two reviewers. A  
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55 further 2,015 papers were found from Scopus and PsychINFO databases and nine met the  
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57 inclusion criteria. If disagreement occurred between two reviewers with regards to exclusion  
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4 criteria then a third reviewer appraised the article and a consensus was reached. A total of 63  
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6 articles were included in the final data extraction.  
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### 9 *Charting the data*

10 A data extraction form was created and data from the most recent five studies were  
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12 independently charted onto Microsoft Excel spreadsheet by two reviewers in order to check  
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14 for consistency. The reviewers discussed whether approaches were consistent and whether  
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16 the data being extracted answered the research question. Following revisions, the final data  
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18 charted were: author(s), year of publication, country of study, aims, research method, setting,  
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20 terminology of diagnoses, treatment approach, type of speech and language symptoms and  
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22 SLT involvement (see supporting information for data extraction chart). Where country of  
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24 study was not explicitly stated, the country of lead author was extracted.  
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## 31 **Results**

### 32 *Distribution of articles by year*

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35 Texts included in the final analysis ranged from 1953 to 2018. The largest proportion of  
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37 articles were published in 2012 (n=8, 13%), followed by 2018 (n=7, 11%). 20 texts (32%)  
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39 were published in the 2000s whereas 36 texts (57%) have been published thus far this decade.  
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41 This indicates a trend for increasing interest in this topic area given that over half of included  
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43 articles were produced in the last eight years.  
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### 50 *Distribution of articles by country of authorship*

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53 A total of 20 countries of publication were included in the final analysis (see supplementary  
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55 material for table of countries). The majority of texts were published in the United States of  
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57 America (USA) (n=25, 40%) followed by the United Kingdom (UK) (n=12, 19%). When  
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grouped into continents, the Americas produced 29 texts (46%), followed by Europe (n=28, 44%), Asia (n=3, 5%), the Middle East (n=2, 3%), and Australasia (n=1, 2%). Two of the papers included in the review involved two countries: France and Serbia (Chen *et al.* 2011); USA and Spain (Cubo *et al.* 2005).

### *Research methods*

A total of 13 different methods were included, with some papers involving more than one method (see Table 1). Case studies were the most frequent method used (n=23, 37%) followed by retrospective analysis of data (n=13, 21%). One randomised controlled trial was included (Moene *et al.* 2002). The focus of this trial, however, was the effectiveness of hypnosis in FND and did not focus on speech and language therapy involvement but was included in this review because 13% of their sample reported “speech disturbance”. Only 18 papers (29%) included speech, language or swallowing symptoms in their aims. The other citations mentioned relevant symptoms in the main body of the text and detail was often lacking.

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Research method	Number of articles
Case report(s)	23
Case control study	2
Cohort study	1
Double dissociation experiment	1
Interview	3
Opinion piece	1
Prospective analysis	5
Questionnaires	4
Randomised controlled trial	1
Rating scale development	2
Report	1
Retrospective analysis	13
Review	8

**Table 1: Distribution of number of articles by research method***Terminology*

A total of ten different terms were used to describe FND within the search results (see Table 2). These terms were used 79 times within the 63 included texts as 13 publications used more than one term within their papers. “Psychogenic” was the term used most frequently (n=24, 38%) followed by “functional” (n=21, 33%) and then “conversion” (n=19, 30%). The term “functional” was used more than other terms in the most recent decade. Ten of the 13 papers which used more than one diagnostic label were produced in the 2010s.

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Diagnostic term	1950s	1960s	1980s	1990s	2000s	2010s	Total
Psychogenic	1			3	8	12	24
Conversion		1		1	9	8	19
Functional		1			2	18	21
Somatoform						3	3
Non-organic						2	2
Non-neurogenic						1	1
Ganser's					1	1	2
Dissociative						2	2
Hysteria	1		1			1	3
Medically unexplained					1	1	2
<b>Total</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>21</b>	<b>49</b>	<b>79</b>

**Table 2: Distribution of articles by terminology of diagnoses and year***Functional stroke mimics*

Four articles were included in the final results which describe functional stroke mimics and include details of speech, language or swallowing symptoms. The number of functional stroke mimics admitted to stroke units ranged from 0.4%-8.4% (Chen *et al.* 2011; Artto *et al.* 2012; Guillan *et al.* 2012; Gargalas *et al.* 2017). A total of 111 patients with functional stroke mimics were described across the four articles. Dysarthria was reported in 20% (n=22) of these patients and dysphasia in 15% (n=17). Gargalas *et al.* (2017) report that dysarthria was the second commonest presentation for functional stroke mimics on admission to a hyper acute stroke unit. This paper also reports that some patients presented with "difficulties swallowing" under "miscellaneous presentations" among the functional stroke mimics. However, specific numbers of patients presenting with dysphagia in this population were not reported.



## Speech, language and swallowing impairments in FND

*Setting*

A total of 20 different settings were reported in the publications with some papers including more than one setting. 30 papers (48%) reported involvement in an inpatient setting and 22 papers (35%) reported involvement in an outpatient setting (see Table 3). Movement disorders clinic was the most frequently reported setting (n=9, 14%). The setting was either not stated or not applicable in 14 papers (22%) and five papers (8%) were conducted in a research centre.

Inpatient setting		Outpatient setting	
Emergency room	5	Brain injury clinic	1
Epilepsy monitoring unit	1	Medical centre	1
Inpatient (speciality not specified)	6	Memory clinic	1
Inpatient rehabilitation ward	3	Movement disorders clinic	9
Neurology ward	4	Neurobehavioural clinic	2
Psychiatric ward	3	Neurology clinic	4
Stroke unit	4	Otology and laryngology department	1
Surgery	3	Outpatient (speciality not specified)	1
Tertiary care centre	1	Psychiatric clinic	1
		Psychology clinic	1
Total	30	Total	22

**Table 3: Distribution of number of articles by setting**

*Speech, language and swallowing symptoms*

A total of 26 papers included more than one relevant symptom for this review. Speech symptoms were reported in 41 of the 63 papers (65%). Publications charted under speech symptoms included articles which specifically stated dysarthria but also if they used terms such as “functional speech disorder” and the details of symptoms were not specified.

Language impairments were reported in 35 papers (56%) and were broken down into the

## Speech, language and swallowing impairments in FND

following symptoms in order of frequency: aphasia (n=22, 35%), dysgraphia (n=5, 8%), mutism (n=5, 8%) and alexia (n=4, 6%). Dysphagia was reported in 13 of the 63 publications (21%). 20 papers included specific numbers of participants who presented with speech, language or swallowing symptoms and FND. These ranged from 2% to 97% (see Table 4).

References	Number of patients	Number of patients with speech, language or swallowing symptoms (%)	Clinical presentation of speech, language or swallowing symptoms
Akyüz <i>et al.</i> (2017)	60	58 (97)	Aphasia
Baizabal-Carvallo and Jankovic (2015)	182	4 (2)	Speech arrests
Baizabal-Carvallo and Jankovic (2017)	9	4 (44)	Abnormal speech
Cantello <i>et al.</i> (2001)	21	2 (10)	Motor aphasia, dysarthria, global aphasia
Cubo <i>et al.</i> (2005)	88 (USA) 48 (Spain)	16 (18) 11 (23)	Speech symptoms
Czarnecki <i>et al.</i> (2012)	60	7 (12)	Speech disorder
Epstein <i>et al.</i> (2016)	36	6(17)	Functional speech
Ertan <i>et al.</i> (2009)	49	4 (8)	Bizarre speech
Factor <i>et al.</i> (1995)	28	1 (4)	Slow halting voice
Fasano <i>et al.</i> (2012)	46	18 (39)	Slurred speech, burst of verbal gibberish
Ganos <i>et al.</i> (2014b)	26	6 (23)	Speech disturbances
Hinson <i>et al.</i> (2005)	88	25 (28)	Speech dysfunction
Jacob <i>et al.</i> (2018)	32	18 (56)	Affected speech
Jokel and Wolf (2017)	10	2 (20)	Dysgraphia, alexia, naming impairment, repetition impairment
Kranick <i>et al.</i> (2011)	64	8 (13)	Speech symptoms
Moene <i>et al.</i> (2002)	45	6 (13)	Speech disturbances
Park (2018)	31	10 (32)	Abnormal speech or voice

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Saifee <i>et al.</i> (2012)	26	Not specifically stated (>50)	Difficulty speaking/slurred speech
		Not specifically stated (<20)	Difficulty swallowing
Sharma <i>et al.</i> (2017)	30	4 (13)	Speech difficulty
Stone <i>et al.</i> (2010b)	107	30 (27) 11(10)	Slurred speech Word finding difficulties

**Table 4: Number of patients (%) who presented with speech, language or swallowing symptoms in 20 papers which included participant numbers and details of presenting symptoms**

### *Speech and language therapy involvement*

Only eight papers report direct speech and language therapy input (13%). The involvement of SLTs for consultation and assessment for diagnosis was described in six papers (10%). Direct therapy was stated in four papers (6%), with two papers stating SLT input for both consultation and therapy. Babin and Gross (2002) report a case study in which a participant received direct dysarthria therapy for slurred speech and tongue protrusion. Jacob *et al.* (2018) report that SLTs were involved in the administration of an interdisciplinary motor retraining program. Czarnecki *et al.* (2012) simply state “therapy” and do not report on details of the therapy and Haubenberger *et al.* (2004) state they used “voice and breathing techniques” for a case study of dysarthrophonia although no further details are given.

### **Discussion**

This scoping review confirms that speech, language and swallowing symptoms do exist in patients with FND. The symptoms themselves, however, have not been the focus of a large amount of the literature. Little empirical research exists regarding the number of patients with FND with these impairments or the effects of SLT input. De Letter *et al.* (2012) suggest that one difficulty in this area is the “dramatic under-reporting” of functional language

## Speech, language and swallowing impairments in FND

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4 disorders. This was evident in our review in that many papers simply mentioned these  
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6 symptoms with little attached detail. Although Czarnecki *et al.* (2012: 248) report that seven  
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8 of their patients presented with functional speech symptoms, they specifically state that  
9  
10 “speech outcomes [are] not included in current analysis”. Baizabal-Carvallo and Jankovic  
11  
12 (2015:2422), in their analysis of the frequency of functional speech and voice disorders in  
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14 patients with functional movement disorders, acknowledge the under-reporting of functional  
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16 communication symptoms and report that “the descriptions often lack detail”. This has  
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18 implications for research and clinical practice as valid conclusions about any included  
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20 symptoms/treatment cannot be made if sufficient detail is not provided. Future research is  
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22 required to accurately determine the prevalence of functional communication and swallowing  
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24 disorders amongst patients with FND in order to direct further research priorities and service  
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26 development.  
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33 One factor which is likely to contribute to the under-reporting of functional speech, language  
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35 and swallowing disorders is the lack of positive diagnostic criteria. Diagnosis of FND itself  
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37 is not a diagnosis of exclusion and positive diagnostic criteria for physical symptoms have  
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39 been validated (Edwards & Bhatia 2012; Daum *et al.* 2014). SLTs, however, do not have  
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41 validated diagnostic criteria. This means that functional communication and swallowing  
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43 disorders may go under-diagnosed and consequently under-reported. Currently, functional  
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45 communication and swallowing disorders are a diagnosis of exclusion (De Letter *et al.* 2012;  
46  
47 Teodoro *et al.* 2018; Kim *et al.* 2018). Further research is needed to validate a set of positive  
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49 diagnostic criteria for SLTs to use both within clinical and research practice.  
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54 Although validated diagnostic criteria for these symptoms do not currently exist, there are  
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56 clinical indicators which might suggest the presence of a functional communication disorder  
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58 (see Table 5).  
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## Speech, language and swallowing impairments in FND

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 Clinical indicators of a functional communication disorder
 

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Inconsistencies or incongruence with:

- Known neurological conditions
- Different audiences
- Symptoms or types of errors made
- Varying topics, settings or assessment tasks
- Oral-motor examination compared with speech produced
- Known patterns of fatigue

Distractibility or suggestibility of symptoms

Rapid improvement to symptomatic therapy

Presence of other functional neurological symptoms

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**Table 5: List of clinical indicators which might suggest a functional communication disorder based on Duffy (2016), Stone *et al.* (2016) and Chung *et al.* (2018)**

These listed indicators need to be considered within the context of a thorough neurological examination (Gill and Damann 2015). An interdisciplinary approach is required for accurate diagnosis and management of FND (Healthcare Improvement Scotland 2012). SLTs are well placed to contribute to the diagnostic assessment of a patient with FND given their specialist knowledge of communication and swallowing disorders. The validation of positive diagnostic criteria, however, would assist in the clear and consistent reporting of these.

The majority of the included papers reported on speech symptoms but were described by professionals other than SLTs. This means that the accuracy of these symptoms being a form of dysarthria, as opposed to a communication impairment in general, cannot be guaranteed.

The inclusion of a speech section on standardised rating scales for FND suggests that speech is considered an important and common enough factor in the presentation of functional disorders to warrant rating. The scales developed by Hinson *et al.* (2005) and Nielson *et al.* (2017a), however, do not comment on what “speech” means or which parameters should be

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4 rated. Nielson *et al.* (2017a) tested their scale with physiotherapists as raters because they  
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6 highlight that these healthcare professionals are those who treat the patients, as opposed to  
7  
8 the diagnosing neurologist. It is these professionals, therefore, who will require the rating  
9  
10 scales in order to measure outcomes of treatment. This highlights a gap for further research  
11  
12 in that current rating scales should be tested for reliability when completed by SLTs.  
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15  
16 Conversely, a rating scale specific to speech, language and swallowing impairments could be  
17  
18 created and validated. This would assist in improving the accurate and consistent reporting  
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20 of speech and language therapy symptoms in the literature and within clinical care.  
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23  
24 Another challenge in the reporting of functional speech, language and swallowing  
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26 impairments is the varying use of terminology used to describe FND. The use of various  
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28 terms in the literature provided difficulties when deciding on inclusion or exclusion of  
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30 articles. This is because authors use terms in interchangeable ways. For example,  
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32 Değirmenci *et al.* (2012) present a case study in which the patient had gait and speech  
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34 disturbance. The authors used the term “psychogenic movement disorder” throughout the  
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36 paper yet concluded that the patient had factitious disorder. This article was, therefore,  
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38 excluded due to deliberate intent to feign symptoms. This highlights, however, both the  
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40 challenge of accurate diagnosis and also the confusing availability of so many terms. This is  
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42 reflected in the fact that almost a third of the papers published in the 2010s used more than  
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44 one term within their reports. This confusion is likely to impact on clinical practice. If the  
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46 literature uses various terms, SLTs cannot readily search for available evidence to inform  
47  
48 management of this patient group. Difficulties engaging in professional conversations  
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50 amongst SLTs regarding FND may also exist due to the wide variety of terminology used.  
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56 Prominent authors in the field of FND have praised the inclusion of the term “functional” in  
57  
58 the DSM-5 and encourage its use as the predominant term (Ganos *et al.* 2014a; Demartini *et*  
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Speech, language and swallowing impairments in FND

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4 *al.* 2016). Within this scoping review, “functional” was the term used most frequently in  
5  
6 recent years. This reflects the change in categorisation in the DSM-5 in that a psychological  
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8 stressor is no longer deemed necessary for classification. The RCSLT’s *Clinical Guidelines*  
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10 (2005) uses the term “psychogenic” in relation to dysfluency and there is no mention of FND  
11  
12 within these guidelines. SLTs as a profession will need to engage in discussions around  
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14 terminology as it will impact on the consistent and clear reporting of functional  
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16 communication and swallowing symptoms, as outlined above. A consensus agreement  
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18 regarding appropriate terminology to use going forwards would be useful for both practising  
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20 clinicians and researchers.  
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26 Interdisciplinary treatment of FND is widely recognised as important both for successful  
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28 diagnosis but also management (Czarnecki *et al.* 2012; Saifee *et al.* 2012; McCormack *et al.*  
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30 2014). Amongst the publications found in the literature review there was a consensus that  
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32 SLTs do have a role to play in the management of patients with FND, despite none of the  
33  
34 papers addressing this directly (Rosebush and Mazurek 2011; Healthcare Improvement  
35  
36 Scotland 2012; Stone *et al.* 2016b; Jokel and Wolf 2017; Chung *et al.* 2018). The role of  
37  
38 occupational therapists has recently been acknowledged with regards to FND (Gardiner *et al.*  
39  
40 2017). It is recognised, however, that consensus guidelines and further research is required  
41  
42 regarding occupational therapy input. Evidence is emerging that suggests physiotherapy is  
43  
44 effective in the treatment of FND (Nielsen *et al.* 2017b). Given that physiotherapy is  
45  
46 effective to treat functional physical symptoms, it is feasible to suggest that speech and  
47  
48 language therapy could be effective to treat functional speech, language and swallowing  
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50 symptoms. Although only a small number of publications in this review reported the direct  
51  
52 input of SLTs, it is possible that this is due to under-reporting as opposed to underutilisation  
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54 of the profession. As the focus of many of the papers was functional movement disorders, it  
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4 is possible that SLT involvement occurred but was not included in the reports. None of the  
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6 papers in the review assessed the effectiveness of speech and language therapy input;  
7  
8 however Stone *et al.* (2016b: 673) state that “experience suggests that symptomatic speech  
9  
10 therapy can be helpful in a large proportion of cases”. Further research is needed to assess  
11  
12 both the short- and long-term impact of specific speech and language therapy techniques in  
13  
14 order to inform future evidence-based clinical practice.  
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17  
18 Another area in which functional speech, language and swallowing symptoms are likely  
19  
20 under-reported is with regards to patients with functional strokes. Papers were excluded from  
21  
22 this review if they did not explicitly state the presence of one of the above symptoms. It is  
23  
24 likely, however, that publications focussing on functional stroke mimics, such as Nazir *et al.*  
25  
26 (2005), would have had patients who presented with functional speech, language or  
27  
28 swallowing symptoms; however these symptoms were not included in their analysis. In the  
29  
30 UK, patients who are admitted with a suspected stroke are placed on a stroke pathway.  
31  
32 National audit targets exist which state that patients should be assessed by all relevant  
33  
34 therapies within 72 hours of admission (Royal College of Physicians no date). Anecdotally,  
35  
36 this means that patients with functional strokes are often referred to speech and language  
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38 therapy on stroke units. Key barriers to the effective explanation and commencement of  
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40 treatment have been identified as a lack of training and possible negative attitudes from  
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42 healthcare professionals (Stone *et al.* 2016a). Studies on the attitudes of interdisciplinary  
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44 members towards functional disorders have highlighted that professionals have limited self-  
45  
46 rated knowledge on how to treat FND and also suggest there is a need for clear guidelines in  
47  
48 the assessment and management of these patients (Espay *et al.* 2009; Edwards *et al.* 2012).  
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50 Currently no literature exists on SLTs’ attitudes and experiences of treating FND. Given that  
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1 Speech, language and swallowing impairments in FND  
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4 patients with functional strokes are being referred to speech and language therapy, this is a  
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6 key avenue for further research.  
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10 A common misconception about FND is that patients are “making it up” which can contribute  
11  
12 to negative attitudes from healthcare professionals (Ahern *et al.* 2009). Patients with FND  
13  
14 have expressed frustration about not having their symptoms believed and the high levels of  
15  
16 uncertainty regarding diagnostic labels (Nettleton *et al.* 2005). Consequently, they often  
17  
18 experience difficulties with physical, emotional and social aspects of their lives, including  
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20 unemployment and withdrawing from friends (Carson *et al.* 2010; Epstein *et al.* 2016).  
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24 Given the significant and wide ranging impacts patients with FND experience and the current  
25  
26 lack of research or guidance for SLTs, it is vital that further research and clinical guidelines  
27  
28 are developed for this patient group in order to optimise their outcomes.  
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### 31 **Strengths and limitations** 32

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34 A strength of the scoping review method is that it covers a wide range of publications, as is  
35  
36 clear in this scoping review with the inclusion of 13 different research methods. A limitation,  
37  
38 however, is that the papers are not quality assessed and this must be considered when  
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40 reviewing the results. Secondly, only papers published in the English language were  
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42 included. This means that relevant papers may exist in languages other than English.  
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46 Another limitation was due to the challenges faced when trying to include and interpret the  
47  
48 wide range of terminology used within this field. When interpretation is involved, a degree  
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50 of subjectivity is inherently present. Although copious searching for relevant terms and  
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52 opinions of multiple authors was sought it is possible that other researchers may have  
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54 interpreted terminology differently from how it has been interpreted in this review. A  
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56 possible way of making this more robust would be to conduct a consultation phase with  
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4 experts in the field of FND, for example SLTs, neurologists and psychologists. This would  
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6 provide further information on the range of terminology used in practice and may have  
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8 highlighted further search terms to include.  
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## 11 **Conclusions**

12 This scoping review highlights that functional speech, language and swallowing symptoms  
13  
14 other than dysphonia, foreign accent syndrome and dysfluency do exist in patients with FND.  
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16 It is clear, however, that this is a largely under-researched area. Further research and  
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18 consensus guidelines are required in order to agree on terminology to be used consistently  
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20 within clinical practice and to develop a set of positive diagnostic criteria. Focussed  
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22 descriptive research is required in order to accurately report on numbers of patients with FND  
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24 with speech, language or swallowing symptoms. Empirical research is also needed in order  
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26 to assess the effectiveness of direct speech and language therapy involvement in order to  
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28 improve outcomes for patients with FND in the future.  
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Speech, language and swallowing impairments in FND

**Appendix I: List of search terms**

speech

language

swallowing

slurred speech

dysarthria

\*phasia

dysfluency

stuttering

\*phonia

dysphagia

word finding difficulties

deglutition

anomia

functional neurological symptom\*

functional neurological disorder\*

psychogenic

conversion disorder\*

somatoform

somati?ation

non-organic

non organic

psychosomatic

1 Speech, language and swallowing impairments in FND

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3  
4 medically unexplained symptoms

5  
6 dissociative disorder\*

7  
8  
9 factitious disorder\*

10  
11 factitious disease

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13 malingering

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15 munchausen

16  
17 ganser syndrome

18  
19 psychomotor disorder\*

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22  
23  
24  
25 inpatient\*

26  
27 hyper acute stroke unit

28  
29 hyperacute stroke unit

30  
31 acute stroke unit

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33 accident and emergency

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35 emergency room

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37 ward

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**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
Afolabi <i>et al.</i> (2016)	USA	To describe a case report of a patient who developed conversion disorder post-operatively	Case report	Conversion disorder	Operating theatre	Not stated	Difficulty speaking	Not stated
Akyüz <i>et al.</i> (2017)	Turkey	To examine the socio-demographic and clinical characteristics, the presence of comorbidity, and the link with childhood traumatic experiences in patients with conversion disorder	Questionnaires	Conversion disorder	Psychiatric outpatient clinic	Psychiatric therapy	Aphasia in 58/60 patients (97%)	Not stated
Al-Samarrai <i>et al.</i> (2001)	USA	To present a case report of a patient with involuntary phrase repetition	Case report	Conversion disorder and functional	Emergency room	Amobarbital interview	Palilalia, writing with letter or word repetition	Evaluation of presentation
Andrade <i>et al.</i> (2009)	India	To describe two case reports of patients with conversion disorder	Case reports	Conversion disorder	Not stated	Systematic enhancement of functioning	Inability to speak	No however authors state they adopted speech therapy techniques: Direct therapy focussing on producing vocalisations then moulding into

### Speech, language and swallowing impairments in FND: Data extraction chart

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
								recognisable words
Artto <i>et al.</i> (2012)	Finland	To characterise cases classified as stroke mimics	Prospective analysis	Conversion disorder	Stroke unit	Not stated	1/14 stroke mimic patients with conversion disorder had dysarthria and 1/14 had dysphasia	Not stated
Babin and Gross (2002)	USA	To review the literature on conversion and malingering, to discuss the most frequently administered tests used for assessment and to present two case reports	Case reports	Conversion disorder	Hospital admission to acute rehabilitation then outpatient brain injury programme	Speech and language therapy, occupational therapy, psychotherapy, group cognitive therapy, adjustment group, community re-entry group	Anomia, slurred speech, prominent tongue protrusion	Administered cognitive tests. Provided direct treatment with a pseudo-scientific explanation
Baizabal-Carvalho and Jankovic (2015)	USA	To characterise the phenomenology, frequency, and correlates of psychogenic speech and voice disorders in a cohort of patients with psychogenic movement disorders	Retrospective review of medical notes and videos	Psychogenic movement disorder, psychogenic speech and voice disorder	Movement disorders clinic	Pharmacotherapy, psychotherapy, stress management	30/182 had psychogenic speech and voice disorder (16.48%). 4/182 had speech arrests (2.20%)	Not stated
Baizabal-	USA	To identify the	Retrospective	Functional,	Movement	Not stated	Abnormal speech	Not stated

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
Carvallo and Jankovic (2017)		frequency and clinical characteristics of functional stereotypies and contrast their clinical features with classic tardive dyskinesia	analysis	psychogenic	disorders clinic		in 4/9 patients (44%)	
Barofsky and Fontaine (1998)	USA	To evaluate whether patients with psychogenic dysphagia are likely to be diagnosed as or resemble eating disorder patients	Self-report questionnaires and comparison of surface electro-myography with various patient groups	Psychogenic	Test setting	Not stated	Dysphagia	Not stated
Bryant and Das (2012)	Australia	To present a case report of the neural circuitry associated with the recovery of chronic conversion disorder	Case report	Conversion disorder and hysterical	Psychology outpatients	Counselling, psychotherapy	Hysterical mutism	Not stated
Cantello <i>et al.</i> (2001)	Italy	To review patients with a diagnosis of psychogenic paralysis and review whether time taken to	Retrospective review	Psychogenic paralysis	Neurology ward	Only stated for 3 case reports: psychiatric counselling, resolution with explanation	2/21 global aphasia (9.52%). 1/21 motor aphasia(4.76%) 1/21 dysarthria (4.76%)	Not stated

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
		make the diagnosis had changed and diagnostic tests used						
Carter (1967)	UK	To describe three different types of functional overlay	Case reports and opinion	Conversion reaction, functional overlay	Neurology outpatient	Explanation, reassurance, suggestion	Mutism	Not stated
Chen <i>et al.</i> (2011)	France and Serbia	To determine the baseline profile and the outcome in patients with stroke mimics who received intravenous thrombolytic therapy	Retrospective analysis of data	Functional symptoms, somatoform disorders	Stroke unit	Not stated	2/7 stroke mimic patients had dysarthria, 1/7 had aphasia	Not stated
Chung <i>et al.</i> (2018)	USA	To discuss the characteristics of functional speech and voice disorders	Review and case reports	Functional disorders of speech and voice	Not stated	Not stated	Childlike prosody, impaired speech	States that SLT involvement can produce dramatic improvements to functional speech and voice disorders
Cubo <i>et al.</i> (2005)	Spain and USA	To compare the phenomenology, anatomical distribution and functional impairment of psychogenic movement	Analysis of data from rating scales of video tapes of patients with psychogenic movement disorder	Psychogenic movement disorder	Medical centre	Not stated	USA: 16/88 had speech symptoms (18.18%). Spain: 11/48 had speech symptoms (22.92%)	Not stated



**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
		disorders in the United States of America (USA) and Spain						
Czarnecki <i>et al.</i> (2012)	USA	1) To describe the protocol conducted in the Department of Physical Medicine and Rehabilitation for functional movement disorder 2) To assess short term and long term outcomes	Historical cohort study	Functional movement disorder	Tertiary care centre	Counselling, physiotherapy, occupational therapy, speech and language therapy, psychiatry, psychology	7/60 had functional speech disorder (11.67%). Speech outcomes not reported	Consultation and therapy
De Letter <i>et al.</i> (2012)	Belgium	1) To present three case reports of patients with a language disorder that is not ascribed to concomitantly present brain lesions 2) To compare the clinical and linguistic features with those of previously reported cases of non-organic	Case reports	Non-organic language disorder	Neurology ward	Pharmacotherapy, rehabilitation	Mutism, agrammatism, phonological paraphasias, paralexias, perseverations, neologisms, word finding difficulties, infantile language behaviour, impaired repetition, agraphia	Not stated

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
		language disorder						
Dwyer and Reid (2004)	UK	To present a case report of a patient with Ganser's syndrome and to review Ganser's syndrome	Case report and review	Ganser's syndrome	Neurology ward	Spontaneous recovery	Alexia, impaired repetition	Not stated
Epstein <i>et al.</i> (2016)	USA	To conduct qualitative interviews in order to enhance understanding of psychologic aspects of functional movement disorders	Interviews	Functional movement disorder	Not stated	Not stated	6/36 participants had "functional speech"	Not stated
Ertan <i>et al.</i> (2009)	Turkey	To outline the clinical characteristics of patients with psychogenic movement disorder	Prospective analysis of clinical characteristics	Psychogenic movement disorder	Movement disorders unit	Not stated	4/49 had bizarre speech (8.16%)	Not stated
Factor <i>et al.</i> (1995)	USA	To review the frequency, clinical profile and characteristics of patients with psychogenic movement disorder	Retrospective analysis	Psychogenic movement disorder	Movement disorders clinic	Spontaneous recovery, psychology, physiotherapy, placebo	1/28 had slow halting voice (3.57%)	Not stated

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
Fasano <i>et al.</i> (2012)	USA	To examine a large series of psychogenic movement disorders where the orofacial region was involved to determine the clinical features and associated disorders and to highlight their inconsistency with recognised organic movement disorders	Retrospective data analysis	Psychogenic movement disorder	Movement disorders centres	Pharmacotherapy, botulinum neurotoxin, psychotherapy	11/46 had slurred speech (23.91%). 7/46 had burst of verbal gibberish (15.22%)	Not stated
Ganos <i>et al.</i> (2014)	UK	To describe the phenomenology, associated features and clinical course of psychogenic paroxysmal movement disorders	Retrospective analysis	Psychogenic	Movement disorders clinic	Explanation of the diagnosis, pharmacotherapy, multidisciplinary neuropsychiatric rehabilitation program, botulinum toxin, placebo	6/26 patients (23%) had speech disturbances. Swallowing difficulties also reported however specific numbers not stated	Not stated
Gargalas <i>et al.</i> (2017)	UK	1) To determine the incidence of functional stroke mimics admitted to a hyperacute stroke unit.	Retrospective data analysis	Functional mimics	Hyperacute stroke unit	Psychology, counselling, neurology, gynaecological/urology, general medical/surgical,	18.4% of functional mimics had dysarthria. 14.3% had dysphasia. Slurred speech	Not stated

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
		2) To compare their clinical characteristics with medical mimics and stroke cases and obtain information about outcomes				ophthalmology, mental health, pain clinic, exercise/physiotherapy, rheumatology, district nurse	was second commonest presenting symptom. Difficulties swallowing also documented	
Gill and Damann (2015)	USA	To review the neuroanatomic basis of language, assessment techniques of language function and disorders affecting language	Review	Language impairment of unexplained etiology (functional or psychogenic)	N/A	Psychotherapy	Slowed speech, agrammatism, aprosodia, impaired articulation	Not stated
Guillan <i>et al.</i> (2012)	Spain	To determine the frequency, clinical features and prognosis of stroke mimic patients treated with intravenous tissue plasminogen activator therapy in an experienced stroke centre	Prospective registry	Somatoform disorder	Stroke unit	Not stated	1/15 stroke mimic patients had dysarthria (6.67%). 1/15 had dysphasia (6.67%)	Not stated
Han <i>et al.</i> (2007)	USA	To present a case report of a patient with conversion locked-in	Case report	Conversion disorder	Surgery	Not stated – spontaneously resolved	Anarthric	Not stated

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
		syndrome						
Haubenberger <i>et al.</i> (2004)	Austria	To present a case report of a patient with unusual speech disorder	Case report	Psychogenic	Not stated	Pharmacotherapy, speech and language therapy	Dysarthrophonia, difficulties swallowing	Voice and breathing therapy
Healthcare improvement Scotland (2012)	UK	To propose a model of stepped care for functional neurological symptoms	Report	Functional neurological symptoms	Whole pathway – from primary to tertiary care	Psychology, psychiatry, physiotherapy, occupational therapy, speech and language therapy, neurology, rehabilitation medicine, chronic pain services	Not stated	Stated in recommendations that SLTs should be involved in rehabilitation
Heruti <i>et al.</i> (2002)	Israel	To review recent as well as historically important medical literature of patients with conversion motor paralysis	Review	Conversion motor paralysis	N/A	Psychology, interdisciplinary rehabilitation, pharmacotherapy	Speech disorders, dysphagia, dysphasia	Not stated
Hinson and Haren (2006)	USA	To review the epidemiology, diagnosis and current treatment options for psychogenic movement disorders	Review	Psychogenic movement disorders	N/A	Psychotherapy, stress management, relaxation, pharmacotherapy, rehabilitation	Speech listed as possible symptom	Not stated
Hinson <i>et</i>	USA	To develop and	Rating scale	Psychogenic	Movement	N/A	25/88 had speech	Not stated

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
<i>al.</i> (2005)		test the clinimetric properties of a scale for psychogenic movement disorders	development, interrater reliability and construct validity testing	movement disorder	disorders referral centre		dysfunction (28.41%)	
Jacob <i>et al.</i> (2018)	USA	To assess outcomes of patients with functional movement disorders undergoing a multidisciplinary treatment program and to determine factors predictive of treatment success	Retrospective analysis	Functional movement disorders	Inpatient treatment program	Motor retraining program including: neurologist, physiatrist, psychologist, physiotherapist, speech and language therapist, occupational therapist, social worker	Speech was affected in 18/32 patients (56%)	Participated in multidisciplinary motor retraining program which involves positive reinforcement of normal movement and ignoring abnormal movements
Jokel and Conn (1999)	Canada	To present a case report of a patient with backward speech and mirror reading and writing	Case report	Conversion disorder	Emergency room, multiple hospital admissions, Behavioural Neurology Unit, psychiatric facility	Sodium amytal interview	Agrammatism, dysgraphia, alexia, mirror speech, impaired repetition and naming, anomia, receptive impairment, mirror writing	Not stated
Jokel and Wolf (2017)	Canada	To provide empirical and clinical evidence	Retrospective review of medical notes	Conversion disorder, Ganser	Not stated	Treatment of cases not specified	2/10 were diagnosed with conversion	Evaluation using speech and language tests

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
		that supports multidisciplinary assessment of patients who present with speech, language and cognitive impairments that do not seem to have a clear organic basis		syndrome			disorder with general language impairments (20%): Dysgraphia, alexia, naming impairment, repetition impairment	
Karpman (1953)	USA	To describe a case report of a patient with psychogenic dysphagia	Case report	Psychogenic, hysterical	Not stated	Psychiatric therapy	Inability to swallow solid food	Not stated
Kim <i>et al.</i> (2018)	Canada	To describe a case report of the use of electroconvulsive therapy to treat psychogenic dysphagia	Case report	Psychogenic	Inpatient	Electroconvulsive therapy	Dysphagia	For assessment of swallowing
Koźmin-Burzyńska <i>et al.</i> (2015)	Poland	To present a case report on psychogenic speech disorder	Case report	Mixed dissociative (conversion) disorder. Psychogenic speech disorder	Psychiatry ward	Psychodynamic group psychotherapy, music therapy, art therapy, psychodrama, relaxation	Speech disorders: cluttering, fast rate of speech, impaired articulation	Consultation for diagnosis
Kranick <i>et al.</i> (2011)	USA	To assess the role of previous life stress using validated	Structured clinical interview, self-report	Psychogenic movement disorder	Research centre	Not stated	8/64 had speech symptoms (12.5%)	Not stated

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
		quantitative measures in patients with psychogenic movement disorder	psychiatric measures					
Levy and Jankovic (1983)	USA	To provide positive diagnostic criteria for hysterical symptoms	Double-dissociation experiment	Hysteria	Test setting	Patient was lost to follow up	Dysfluency, dysarthria, telegraphic speech, paraphasias, circumlocution, slow comprehension	Not stated
Mendez (2018)	USA	To identify and classify non-neurogenic language disorders and their characteristics	Literature review	Non-neurogenic language disorders, psychogenic	N/A	Not stated	Description of possible non-neurogenic language disorders	Not stated
Mishra <i>et al.</i> (2011)	Switzerland	To present a case report of a patient with left hemiparesis, mutism and retrograde amnesia	Case report	Dissociative and psychogenic	Hospital then Neurobehavioural Disorder Clinic	Not stated	Mutism	Not stated
Moene <i>et al.</i> (2002)	Netherlands	1) To examine the additional effects of hypnosis aimed at symptom reduction in a	Randomised controlled trial	Conversion disorder	Outpatient or inpatient treatment	Nursing, group therapy, creative therapy, sports therapy, physiotherapy,	6/45 had speech disturbances (13.33%)	Not stated



**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
		treatment programme for inpatients with a persistent conversion disorder 2) To assess whether the level of hypnotisability was predictive of treatment outcome 3) To explore the efficacy of the total clinical treatment programme				hypnosis		
Nakamura <i>et al.</i> (2002)	Japan	To present two case reports of patients with functional retrograde amnesia with impairment of object use	Case reports	Functional	Hospital	Not stated	Deficits in naming, oral reading and writing, word finding difficulties, comprehension difficulties at single word level	Not stated
Nettleton <i>et al.</i> (2005)	UK	To explore the narratives of patients with medically unexplained illness	In-depth interviews	Medically unexplained illness	Neurology clinic	Not stated	1 participant had swallowing difficulties and 1 had slurred speech (not all symptoms of all participants were	Not stated

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
							listed)	
Nielson <i>et al.</i> (2017)	UK	To develop a simplified version of the Psychogenic Movement Disorders Rating Scale and to assess the interrater reliability, concurrent validity and sensitivity	Rating scale development, interrater reliability, concurrent validity and sensitivity testing	Functional (psychogenic) movement disorder	Not stated	N/A	Speech disorder included on rating scale	Not stated
Park (2018)	South Korea	To describe incidence and clinical and phenomenological characteristics of functional movement disorder patients	Retrospective analysis	Functional movement disorder	Outpatient neurology clinic	Antidepressants	Abnormal speech or voice in 10/31 patients (32%) however also states 12/31 (39%) had affected speech or voice. Infantile speech and dysarthria listed as symptoms	Not stated
Power <i>et al.</i> (2018)	Ireland	To present a case report of a patient with conversion disorder	Case report	Conversion disorder	Memory clinic	Trauma-focussed counselling	Word finding difficulties	Not stated
Rosebush and Mazurek (2011)	Canada	To review the treatment of conversion disorder	Review and opinion piece	Conversion disorder	N/A	Psychotherapy, hypnotherapy, narcotherapy, pharmacotherapy	Speech disturbances listed as possible symptoms of	Opinion statement reports SLTs should be involved, when

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
							conversion disorder	appropriate for rehabilitation
Sachar and Stimson (2015)	UK	To describe a case report of a patient who presented multiple times to the emergency department with functional dysphagia	Case report	Functional dysphagia, somatoform disorder	Emergency department	Pharmacotherapy, relaxation and education therapy, cognitive behaviour therapy	Dysphagia	Not stated
Saifee <i>et al.</i> (2012)	UK	To evaluate the long term efficacy of a multidisciplinary inpatient programme for patients with functional motor symptoms and to identify factors associated with good outcome	Questionnaires	Functional neurological disorder	Inpatient programme	Neurophysiotherapy, occupational therapy, cognitive behavioural therapy, nursing, neuropsychiatry, neurology	Difficulty speaking/slurred speech (over 50%). Difficulty swallowing (just under 20%)	Not stated
Schwartz <i>et al.</i> (2001)	USA	To present cultural and social considerations in a case study of conversion disorder	Case report	Conversion disorder	Emergency room then inpatient neurology ward	Psychiatric interview, psychotherapy, inpatient psychiatric hospitalisation, hypnosis, pharmacotherapy	Dysarthria	Not stated
Shapiro <i>et al.</i> (1997)	USA	To discuss the clinical features and strategies for	Prospective data collection from clinical	Psychogenic	Department of Otology and	Psychology, relaxation, hypnosis	Phagophobia	Not stated

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
		the assessment and treatment of phagophobia	histories, videofluoroscopic evaluation of swallowing and barium swallow study		Laryngology			
Sharma <i>et al.</i> (2017)	USA	To assess clinical outcomes in patients with functional movement disorders who underwent psychodynamic psychotherapy	Retrospective analysis	Functional movement disorders	Movement disorders clinic	Psychodynamic psychotherapy	Speech difficulty in 4/30 patients (30%)	Not stated
Stone <i>et al.</i> (2010)	UK	To describe the incidence, demographic and clinical characteristics of cases with functional weakness of less than 2 years duration, and to compare these with controls with weakness attributable to neurological disease	Prospective analysis, questionnaires, interviews	Functional weakness	Neurology clinics	Not stated	Slurred speech in 30/107 patients (28%). Word finding difficulties in 11/107 patients (10%)	Not stated
Stone <i>et al.</i> (2016)	UK	To present case reports of patients	Review	Functional disorder	N/A	Symptomatic speech and	Articulation deficits are third	Opinion statement that therapy can

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
		with functional disorders				language therapy	commonest functional speech disorder (after dysfluency and dysphonia)	be effective
Stonnington <i>et al.</i> (2006)	USA	To present a case report of a patient with nonepileptic seizures and psychogenic tremors	Case report	Conversion disorder	Emergency room then epilepsy monitoring unit	Psychotherapy, pharmacotherapy, hypnosis	Monosyllabic speech, voice disturbance	Not stated
Suntrup <i>et al.</i> (2014)	Germany	To investigate cortical swallow-related activation in patients diagnosed with functional dysphagia using magnetoencephalograph	Case control study	Functional	Test setting	Not stated	Dysphagia	Not stated
Teodoro <i>et al.</i> (2018)	UK	To define the key neuropsychological characteristics of fibromyalgia, chronic fatigue syndrome and functional neurological disorder	Systematic review	Functional cognitive disorder	N/A	Not stated	Naming and/or fluency abnormalities found in patients with non-epileptic attacks	Not stated
Thomas <i>et al.</i> (2006)	USA	To assess the relationship between underlying	Telephone survey, retrospective analysis	Psychogenic movement disorder	Movement disorders clinic	Pharmacotherapy, placebo, biofeedback, relaxation,	Dysarthria, word finding difficulties, mutism. Specific	Not stated

**Speech, language and swallowing impairments in FND: Data extraction chart**

Author and year	Country	Aim	Research Method	Terminology of diagnoses	Setting	Treatment approach	SLT symptoms	SLT involvement
		psychiatric factors and long-term prognosis of psychogenic movement disorders				psychology, psychiatry, physiotherapy	number of patients with these symptoms not stated	
Vaiman <i>et al.</i> (2008)	Israel	To investigate the usefulness of surface electromyography of psychogenic swallowing disorders	Case control study	Psychogenic	Test setting	Not stated	Dysphagia	Not stated
Witte and Mariën (2015)	Belgium	To present a case report of a patient with non-organic language deficits following awake brain surgery	Case report	Psychogenic and non-organic language disorder	Surgery	Not stated	Receptive dysphasia, anomia	Not stated
Yazici <i>et al.</i> (2004)	Turkey	To present the somatosensory evoked potential responses in two patients with conversion disorder	Case reports	Conversion disorder	Hospital and inpatient psychiatric ward	1) Psychotherapy and pharmacotherapy 2) Electroconvulsive therapy	1) Slurred speech 2) Speech difficulties	Not stated

N/A=not applicable; UK=United Kingdom; USA=United States of America

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**Speech, language and swallowing impairments in FND: Distribution of articles by year of publication and country of origin (UK=United Kingdom, USA= United States of America)**

	Australia	Austria	Belgium	Canada	Finland	France	Germany	India	Ireland	Israel	Italy	Japan	Poland	South Korea	Spain	Switzerland	The Netherlands	Turkey	UK	USA	Total per year
1953																				1	1
1967																			1		1
1983																				1	1
1995																				1	1
1997																				1	1
1998																				1	1
1999				1																	1
2001											1									2	3
2002										1		1					1			1	4
2004		1																1	1		3
2005															1				1	1	3
2006																				3	3
2007																				1	1
2008										1											1
2009								1										1			2
2010																			1		1
2011				1		1										1				1	4
2012	1		1		1										1				2	2	8
2014							1												1		2
2015			1										1						1	2	5
2016																			1	2	3
2017				1														1	2	2	6
2018				1					1					1					1	3	7
Total per country	1	1	2	4	1	1	1	1	1	2	1	1	1	1	2	1	1	3	12	25	63